

L-THIA EXERCISE

Overview

This exercise was developed for the Fox-Wolf Watershed Alliance - Stormwater 2003 Conference. Funding was provided by the University of Wisconsin – Sea Grant Institute and UW – Land Information Computer Graphics Facility. The authors are Brea Lemke and David Hart.

This exercise is based on Purdue University and EPA’s L-THIA program. It also uses the L-THIA documentation as a source of information. The assumptions are that this exercise will be presented to land use or water resource professionals or municipal officials that have little or no experience in stormwater modeling and its connectivity to Geographic Information Systems (GIS).

L-THIA is an extension to ESRI’s ArcView 3.x. Spatial Analyst is also required as an add-on to ArcView. Internet connection is also needed to download the extension.

L-THIA Extension Download & Set-up

1) Download the L-THIA extension from Purdue University at http://www.ecn.purdue.edu/runoff/lthia/gis/lthia_gis.htm

Click on “L-THIA GIS Extension Software Zip File with Sample GIS Dataset” to download the file.

The current version (when this exercise was written) is 2.3 and was released on January 10, 2003.

2) Unzip the file “lthia_gis_ext_v23_and_sample_gis_data.zip” to C:\LTHIA. Follow the “Readme” file for set-up instructions.

Data Download & Set-up

1) Unzip the data for this exercise, which is available for download from the LCIGF website: <http://coastal.lic.wisc.edu/stormwater/>

2) Store this data in a folder called C:\LTHIA.

Create ArcView Project

1) Open ArcView 3.x. Create a new project and open a new view. Do not add data at this time.

2) To add the L-THIA Extension, open the “Extensions” command, under the “File” menu. Select the Extension “L-THIA NPS GIS”.

- Click on the “Add Theme” button. Choose to add the landuse and soil data for the Town of Westport (which includes the City of Waunakee), in Dane County now. From the C:\LTHIA folder, add “land-use_westport.shp” and “soils_westport.shp”.

Note: The Town of Westport data is already in the proper format for this exercise. (The yellow box below describes this format to help people use their own data for L-THIA.)

The land use and soil hydrologic group themes must have fields that follow L-THIA conventions. The land use theme must contain a conventional land use classification and code fields. The soils theme must have a field that contains hydrologic soil groups and associated codes.

Specifically, the land use attribute data must follow the land use naming conventions recognized by L-THIA GIS. These are:

The attribute field must be named “Recls_land”.

Legal Land Use	Code
<i>Water</i>	<i>1000</i>
<i>Commercial</i>	<i>2000</i>
<i>Agriculture</i>	<i>3000</i>
<i>HD Residential</i>	<i>4000</i>
<i>LD Residential</i>	<i>5000</i>
<i>Grass/Pasture</i>	<i>6000</i>
<i>Forest</i>	<i>7000</i>
<i>Industrial</i>	<i>8000</i>

The soil theme must contain a “Recls_hsg” field that contains the hydrologic soil group and associated code:

Legal Hydrologic Soil Group	Code
<i>A</i>	<i>1</i>
<i>B</i>	<i>2</i>
<i>C</i>	<i>3</i>
<i>D</i>	<i>4</i>

- Save this project as “lthia_exercise.apr”.
- Under the “L-THIA GIS” menu, select “Land Use Classification”.

This function will create additional fields to the land use theme table that are used to calculate the curve number. This function also creates a grid version of the land use theme.

- The first screen will ask for your working directory, where your data will be saved. Specify the C:\LTHIA folder. Another screen will ask for the “Land Use Classification” file, select “land-use_westport.shp”. A third screen will ask for a name for the grid file. Save as “lu_grid”. Finally specifications will be asked about the grid size; maintain the default information.

- 7) Proceed with a similar function for the soils theme. Under the “L-THIA GIS” menu, select “Soils Classification”.
- 8) Again select the working directory and specify the file “soils_westport.shp” when prompted for the “Hydrologic Soil Classification” file. Convert the shapefile to a grid file named “soil_grid”. Again, maintain the default information for the grid size.
- 9) Now we can calculate the Curve Number, since the land use and soil grids are created. Select “Calculate the CN” command from the “L-THIA GIS” menu”.
- 10) A series of screens will appear. Specify the working directory (where data is to be saved). Choose the land use grid as “lu_grid” and the soil grid as “soil_grid”. In choosing a name, click “Cancel” to maintain the default name: “Curve Number generated from ‘lu_grid’ and ‘soil_grid’”. Click “OK” on the “Statistics CN_Value Field”.

The Curve Number theme is added to the view.

- 11) Next, precipitation data for Dane County will be added. It has been downloaded ahead of time from L-THIA’s website and is called “dane.txt”.

Precipitation data for the United States is available from the L-THIA web page at <http://www.ecn.purdue.edu/runoff>

- 12) Run the L-THIA model by selecting “Run L-THIA GIS” from the “L-THIA GIS” menu.
- 13) A series of windows will appear:
 - In the window that asks “Do you want to run L-THIA with an already saved input file?” Click “No” since this is the first time using the model.
 - Answer “OK” to the screen that gives directions of input file information.
 - Select “Yes” to create a new input file for running L-THIA-NPS.
 - Create a new input file named “input1”.
 - Click “Ok” for the prompt to specify a precipitation file name.
 - Specify the Precipitation file as “dane.txt”.
 - Select “Yes” to run the L-THIA program. The input file will be built with the rainfall data.
- 14) Next, a screen will let the user choose the Antecedent Moisture Condition (AMC). Select the “Normal AMC (AMC II) Condition”.
- 15) A notice will appear, stating that a DOS window will pop up. Click “Ok”.

The DOS window will appear and indicates that L-THIA is calculating annual average direct runoff depth for a series of Curve Number. This process will take a few minutes to run.

- 16) The output files are also prepared, so now a runoff depth can be calculated. From the “L-THIA GIS” menu, select “Runoff Depth (Average Annual)”.

A series of screens will appear:

A notice will appear stating that L-THIA will create the annual average Runoff map. Click “Ok”.

Next, select the curve number theme, by the same name.

Specify the LTHIA Results file as “dane.gph”.

For the theme name, save as “LTHIA Runoff Depth (cm)”.

17) Notice the average annual runoff depth theme is added to the map view.

The Runoff Depth (Single Storm) command will create a runoff depth theme using the CN method.

18) This runoff depth map that was just created can be used to create a runoff volume map. From the “L-THIA GIS” menu, select “Runoff Volume”.

In following series of screens, enter the following:

Choose the Runoff Depth Theme as “LTHIA Runoff Depth (cm)”.

In selecting a Theme Name, click “Cancel” to use the default name: “Runoff Volume (m³/cell)”.

The Runoff Volume Theme will be added to the map view.

19) After we have a runoff volume, we can estimate the annual Non Point Source Pollutant loading. NPS pollution can be estimated from the runoff volume theme and event mean concentration (EMC) NPS data.

Select the “NPS Pollutant Loading” command from the “L-THIA GIS” menu.

20) A series of windows will appear:

Select “Yes” to continue estimating NPS pollution using EMCs for each landuse.

Select the Runoff Volume theme, that was created in the previous step.

Use the default name (select “Cancel”) for the new theme name: “Nonpoint Source(TN: kg/cell)”.

The new Nonpoint Source Theme will be added to the view.

21) Open the Attribute Table for the new theme. Notice the values of average annual loading for NPA pollutants are listed.

Runoff Depth (CN method) can computed for a specific storm event, instead of getting the average annual runoff for the area.

Other L-THIA Features:

L-THIA GIS Update

This function allows the user to check for the newest version of the extension with an internet connection.